

COLD STORAGE WAREHOUSE UNITS IN INDIA - A REGION-WISE COMPARATIVE STUDY

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ABSTRACT

Cold chains are essential for extending shelf life and reduce transport bottlenecks during peak period of production. The Indian cold storage market is valued at Rs. 117 billion and is expected to reach Rs. 558 billion by the end of 2015. Eleven per cent of world's total vegetables production is accounted by India alone but India's share in global vegetable trade is only 1.7%. To examine the cold storage warehouse status in India, a region-wise comparative analysis based on secondary data has been carried out. The collected data was grouped region-wise and analysed using simple percentage analysis. Results showed that the concentration of cold storage warehouses was higher in the Northern region. Capacity of cold storage warehouses for storing potatoes was largest (74.73 percent) followed by multipurpose cold storages (22.24 percent). In all the four regions, concentration as well as capacity of private cold storage warehouses was highest. The overall storage capacity of cold storage available in the country cannot be considered adequate. There are number of gaps in India's cold chain right from postharvest handling to maintaining proper temperature throughout the cold chain. These requirements can only be fulfilled with an intervention of private sector, and public-private partnerships.

KEYWORDS: Cold Storage Warehouses, Indian Cold Storage Sector, Cold Chain Industry, Cold Stores

INTRODUCTION

Cold chains are essential for extending the shelf life, period of marketing, avoiding over capacity, reducing transport bottlenecks during peak period of production and maintenance of quality of produce. The development of cold chain industry has an important role to play in reducing the wastages of the perishable commodities and thus providing remunerative prices to the growers (ONICRA, 2014). A cold storage is a temperature-controlled storage space and caters to industries such as agriculture, horticulture, fisheries and aquaculture, dairy and processed food.

The Indian cold storage market is valued at Rs. 117 billion and is expected to reach Rs. 558 billion by the end of 2015 (PwC, 2011). Cold chain industry in India is expected grow through increased investments, modernization of existing facilities, and establishment of new ventures via private and government partnerships (ASSOCHAM, 2013).

About 88-90% of market share is with the Temperature Controlled Warehouses (INR162 billion) which consists of 6500 cold storage warehouses and stores with a storage capacity of 30.4 million MT. The Remaining 10-12% comprises of Temperature Controlled Vehicles (INR 13-14 billion) with more than 8000 vehicles (YES Bank report, 2014).

The key industries served by the cold chain industry are fruits and vegetables, ice cream, processed meat and poultry, marine products, preventive medicine (mainly vaccines) and chemicals. A strong cold chain industry ensures improved availability of food products as well as prevents spoilage of medicines, and therefore has a critical role to play in a country like India. The perishable food production in India is estimated at 115 million MT of milk, 200 million MT of fruits and vegetables and 6.4 million MT of fish. India has largest cattle and poultry population in the world. Refrigerated warehousing growth is linked to size of economy and population, wealth of people, food Industry and food trade, food Culture, household consumption and export and import of food [Source: Ingersoll Rand International (India) Ltd. 2013].

Eleven per cent of world's total vegetables production is accounted by India alone but India's share in global vegetable trade is only 1.7%. About 20%-30% of fish production is annually wasted in India. There are 25,000 unregistered slaughter houses in India, which generally lack chilling facilities. (ASSOCHAM, 2013)

REVIEW OF LITERATURE

According to Fernie and Sparks (2004), cold chains have been evolving since 1980s. Earlier, cold chains simply meant storing at a specific temperature in warehouses and refrigerated vehicles. There was no awareness of integrating the supply chain links and as a result billions' of dollars worth of losses occurred every year.

Gundewadi (2013) in his study on the "Role and Performance of Cold Storages in Indian Agriculture" has evaluated the role and performance of cold storages in India, state wise and district wise in Maharashtra. He stated that the cold storage industry played a vital role in the economy of the country and increased the availability of food products, fruits and vegetables for the consumers throughout the year which otherwise was not possible. He opined that cold storages have not received adequate support system from the government.

Basediya (2013) on his review paper on "Evaporative Cooling System for Storage of Fruits and Vegetables" opined that India is the fruit and vegetable basket of the world. About 23–35% of the horticulture produce goes waste due to improper post harvest operations and due to shortage of enough storage facilities.

Anju (2014) examined market challenges pertaining to cold chain in the frozen food industry in Indian retail sector. She identified the potential as well as the challenges that existed in the frozen food business in India. She opined that the frozen food market is one of the largest and most dynamic sectors of the food industry. In spite of considerable competition between the frozen food industry and other sectors, extensive quantities of frozen foods were being consumed all over the world.

RESEARCH METHODOLOGY

Secondary data on Cold storage warehouses was collected from various sources such as National Horticulture Board (NHB), Ministry of Food Processing Industries ((MoFPI), FAOSTAT, Directorate of Marketing and Inspection (DMI), National Horticulture Mission (NHM), Agricultural Marketing Information Network (AGMARKNET), The Department of Agriculture and Cooperation, The Agricultural and Processed Food Products Export Development Authority (APEDA), National Bank for Agriculture and Rural Development (NABARD), National Cooperative Development Corporation (NCDC) and INDIASTAT. The collected data was grouped region-wise (Eastern, Western, Northern and Southern).

The states included under each region are as follows:

- **Eastern Region:** Andaman and Nicobar, Arunachal Pradesh, Assam, Bihar, Jharkhand, Manipur, Meghalaya, Mizoram, Nagaland, Orissa, Sikkim, Tripura and West Bengal.
- **Western Region:** Chhattisgarh, Gujarat, Goa, Maharashtra and Madhya Pradesh.
- **Northern Region:** Delhi, Jammu and Kashmir, Himachal Pradesh, Chandigarh, Haryana, Punjab, Rajasthan, Uttar Pradesh and Uttarakhand.
- **Southern Region:** Andhra Pradesh, Karnataka, Kerala, Tamil Nadu, Pondicherry and Lakshadweep.
- The collected data was analyzed using simple percentage analysis.

RESULTS AND DISCUSSIONS

The data included particulars such as, number of cold storage warehouses located in each state, capacity of cold storage warehouses, commodity-wise category of the cold storage warehouses and sector under which the cold storage warehouses are operated. This data was subjected to analyses and the results are presented.

Table 1: Region-Wise Concentration and Capacity of Cold Storage Warehouses in India
(In metric tonnes)

Region	Total Number of CSW	Percentage Share	CSW Capacity	Percentage Share	Average Capacity
Eastern	1034	15.01	8038738	25.26	7774.41
Northern	3422	49.66	17036442	53.53	4978.50
Western	1478	21.45	4269815	13.42	2888.99
Southern	957	13.89	2478706	7.79	2590.08
Total	6891	100	31823701	100	4618.15

From the Table 1, it can be inferred that Cold storage warehouses were concentrated in the Northern region followed by Western, Eastern and Southern regions. In terms of capacity Northern region had the highest capacity followed by Eastern, Western and Southern regions.

The average capacity of cold storage warehouses in India was 4618.15 MT. The average capacity of cold storage warehouses in Eastern region was found to be the highest with 7774.41 metric tonnes of capacity followed by Northern, Western and Southern regions.

Table 2: Commodity-Wise Concentration of Cold Storage Warehouses in the Four Regions of India
(In numbers)

Region	Potatoes	Multipurpose	Fruits & Veg.	Meat & Fish	Milk & Milk Products	Others	Total
Eastern	730 (70.60)	248 (23.98)	5 (0.48)	50 (4.84)	0 (0.00)	1 (0.10)	1034 (100.00)
Western	474 (32.07)	465 (31.46)	134 (9.07)	194 (13.13)	163 (11.03)	48 (3.25)	1478 (100.00)
Northern	2495 (72.91)	815 (23.82)	13 (0.38)	12 (0.35)	46 (1.34)	41 (1.20)	3422 (100.00)
Southern	10 (1.04)	426 (44.51)	47 (4.91)	350 (36.57)	78 (8.15)	46 (4.81)	957 (100.00)

(Figures in parentheses represent percent to total)

Table 2 indicates the number of cold storages specialized in storage of specific commodities in all the four regions. From Table 2, it can be inferred that majority of the cold storages for stored potatoes (53.82 percent) followed by multipurpose cold storages (28.36 percent). Within Eastern, Western and Northern regions, the share of potato cold storage warehouses was higher followed by multipurpose cold storage warehouses. In Southern region alone the concentration of multipurpose (44.51 percent) followed by meat and fish storing cold warehouses (36.57 percent) was more.

Table 3: Region-Wise Concentration of Cold Storage Warehouses Based on Commodity Stored

(In numbers)

Region	Potatoes	Multipurpose	Fruits & Veg.	Meat & Fish	Milk & Milk Products	Others
Eastern	730 (19.68)	248 (12.69)	5 (2.51)	50 (8.25)	0 (0.00)	1 (0.74)
Western	474 (12.78)	465 (23.80)	134 (67.34)	194 (32.01)	163 (56.79)	48 (35.29)
Northern	2495 (67.27)	815 (41.71)	13 (6.53)	12 (1.98)	46 (16.03)	41 (30.15)
Southern	10 (0.27)	426 (21.80)	47 (23.62)	350 (57.76)	78 (27.18)	46 (33.82)
Total	3709 (100.00)	1954 (100.00)	199 (100.00)	606 (100.00)	287 (100.00)	136 (100.00)

(Figures in parentheses represent percent to total)

The values in Table 3 represent the number of cold storages under each commodity and each region. The values in the parentheses indicate share of each commodity based cold storages across the four regions.

From Table 3, it can be inferred that Potatoes based cold storages were highest in Northern region (67.27 percent) followed by Eastern region (19.68 percent), because potato production and consumption is highest in these regions especially in Uttar Pradesh, West Bengal and Bihar which contribute 71.99 percent of total potato production in India (Ministry of Agriculture and Co-operation, 2014). Concentration of multipurpose cold storages was also high in Northern region (41.71 percent) followed by Western (23.80 percent) and Southern regions (21.80 percent). In southern region, most of the multipurpose cold storages were filled with red chillies. The other products stored in multipurpose cold storage warehouses included tamarind, turmeric, coriander, bengalgram, blackgram, corn, soapnut etc., In Northern states such as Himachal Pradesh, Jammu and Kashmir and Uttar Pradesh, some of the multipurpose CSW's store apples and other deciduous fruits.

The CSW's specialized in fruits and vegetables storage was higher in Western region (67.34 percent) where mostly the fruits such as grapes, oranges, mosambi etc., were stored. Cold warehouses for storing meat and fish were higher in Southern region (57.76 percent) since Andhra Pradesh, Tamil Nadu, Karnataka and Kerala put together, accounted for 44.09 percent of fish production in India (Institute for Ocean Management, 2012).

Cold warehouses storing milk and milk products were concentrated in Western region (56.79). Around 22.57 percent of country's milk production was from these five states of Western region viz. Gujarat, Madhya Pradesh, Maharashtra, Goa and Chhattisgarh (NDDB and INDIASAT, 2014).

Other than these five commodity-based cold storage categories, the other cold storages were smaller cold storages maintained at retail level or by the restaurants, hotels and at airports. These cold storage warehouses were more concentrated in Western region and especially in Maharashtra state.

Table 4: Commodity-Wise Total Cold Storage Warehouse Capacity in the Four Regions of India
(In metric tonnes)

Region	Potatoes	Multi-Purpose	Fruits & Veg.	Meat & Fish	Milk & Milk Products	Others	Total
Eastern	7075414 (88.02)	936355 (11.65)	12937 (0.16)	12832 (0.16)	0 (0.00)	1200 (0.01)	8038738 (100.00)
Western	2560873 (59.98)	1511107 (35.39)	57894 (1.36)	95998 (2.25)	39035 (0.91)	4908 (0.11)	4269815 (100.00)
Northern	14120154 (82.88)	2869782 (16.84)	10442 (0.06)	7489 (0.04)	21962 (0.13)	6613 (0.04)	17036442 (100.00)
Southern	26630 (1.07)	1761723 (71.07)	156678 (6.32)	225258 (9.09)	153555 (6.19)	154862 (6.25)	2478706 (100.00)

(Figures in parentheses represent percent to total)

The values in Table 4, depicts the capacity of cold storage warehouses under major commodities under each region. The values in the parentheses, indicates the share of cold storages in terms of their capacity based on different commodity stored under each region.

From Table 4, it can be observed that the total capacity of cold storage warehouses for storing potatoes was largest (74.73 percent) followed by multipurpose cold storages (22.24 percent). Potatoes storing cold warehouses (82.88 percent) followed by multipurpose cold storage warehouses (16.84 percent) were larger in capacity in Northern region. In Northern states such as Himachal Pradesh, Jammu and Kashmir and Uttar Pradesh, some of the multipurpose CSW's stored apples and other deciduous fruits. Other cold warehouses storing fruits and vegetables, meat and fish and dairy products were larger in capacity in Southern region alone with a percent share of 6.32 percent and 9.09 percent respectively.

Table 5: Region-Wise Total Cold Storage Warehouse Capacity Based on Commodity Stored
(In metric tonnes)

Region	Potatoes	Multi-Purpose	Fruits & Veg.	Meat & Fish	Milk & Milk Products	Others
Eastern	7075414 (29.75)	936355 (13.23)	12937 (5.44)	12832 (3.76)	0 (0.00)	1200 (0.72)
Western	2560873 (10.77)	1511107 (21.35)	57894 (24.33)	95998 (28.10)	39035 (18.19)	4908 (2.93)
Northern	14120154 (59.37)	2869782 (40.54)	10442 (4.39)	7489 (2.19)	21962 (10.24)	6613 (3.95)
Southern	26630 (0.11)	1761723 (24.89)	156678 (65.84)	225258 (65.95)	153555 (71.57)	154862 (92.41)
Total	23783071 (100.00)	7078967 (100.00)	237951 (100.00)	341577 (100.00)	214552 (100.00)	167583 (100.00)

(Figures in parentheses represent percent to total)

The values in Table 5, depicts the region wise capacity of cold storage warehouses under each commodity. The values in parentheses, indicates the capacity share of each cold storage warehouse under different commodities across the four regions.

From Table 5, it can be observed that the capacity of Potatoes based cold storages was highest in Northern region (59.37 percent) followed by Eastern region (29.75 percent). The total capacity of multipurpose cold storages was also highest in Northern region (40.54 percent) followed by Southern region (24.89 percent). Though the concentration of CSW's was higher in Western region than Southern region, the total capacity of cold storage warehouse was higher for Southern region than Western region, because in Western region lower capacity CSW's were more with a capacity of 1.51million metric tonnes while in Southern region higher capacity CSW's were more with a storage capacity of 1.76 million metric tonnes.

The capacity of cold storage warehouse for storing fruits and vegetables (1.56 lakh MT), meat and fish (2.25 lakh MT), dairy products (1.53 lakh MT) and others (1.54 lakh MT) was larger for Southern region even when the number of CSW was low.

Among the four regions Northern region has largest storage capacity owing to larger capacity of potato storing cold storage warehouses.

Table 6: Sector-Wise Cold Storage Warehouses in the Four Regions of India
(In numbers)

Region	Private Sector	Cooperative Sector	Public Sector	Total
Eastern	890 (86.07)	115 (11.12)	29 (2.80)	1034 (100.00)
Western	1308 (88.50)	113 (7.65)	57 (3.86)	1478 (100.00)
Northern	3198 (93.45)	165 (4.82)	59 (1.72)	3422 (100.00)
Southern	844 (88.19)	56 (5.85)	57 (5.96)	957 (100.00)

(Figures in parentheses indicate percent to total)

The values in Table 6 represent the number of cold storages owned by different sector. The values in parentheses indicates share of each sector within the region.

Table 6 explains that in all the four regions the concentration of private cold storage warehouses was more (90.55 percent), followed by co-operatives (6.52 percent) and public cold storage warehouses (2.93 percent). Earlier to 2010, the concentration of cooperative cold storage warehouses was very less which has tremendously increased during the span of next five years.

Table 7: Region-Wise Cold Storage Warehouses Based on Pattern of Ownership
(In numbers)

Region	Private Sector	Cooperative Sector	Public Sector
Eastern	890 (14.26)	115 (25.61)	29 (14.36)
Western	1308 (20.96)	113 (25.17)	57 (28.22)
Northern	3198 (51.25)	165 (36.75)	59 (29.21)
Southern	844 (13.53)	56 (12.47)	57 (28.22)
Total	6240 (100)	449 (100)	202 (100)

(Figures in parentheses indicate percent to total)

Table 7 presents the pattern of ownership of CSW under each region. The values in the parentheses indicates sector-wise share of cold storage warehouses across the four regions.

The concentration of private cold storage warehouses was largest in Northern region (51.25 percent) followed by Western region (20.96 percent), Southern region (13.53 percent) and Eastern region (14.26 percent). In case of cooperative cold storages also the concentration was higher in Northern region (36.75 percent) followed by Eastern (25.61 percent), Western (25.17 percent) and Southern regions (12.47 percent). In case of public sector Western region and Southern region had equal concentration of public CSW's of 57 units each contributing 28.22 percent. Northern region had larger concentration of public cold storage warehouses among all the four regions.

Table 8: Sector-Wise Cold Warehouse Storage Capacity in the Four Regions of India
(In metric tonnes)

Region	Private Sector	Cooperative Sector	Public Sector	Total
Eastern	7464648 (92.86)	542675 (6.75)	31416 (0.39)	8038739 (100.00)
Western	4044909 (94.73)	192086 (4.50)	32818 (0.77)	4269813 (100.00)
Northern	16558704 (97.20)	411571 (2.42)	66168 (0.39)	17036443 (100.00)
Southern	2418790 (97.58)	32122 (1.30)	27794 (1.12)	2478706 (100.00)

(Figures in parentheses indicate percent to total)

The values in Table 8 represent the capacity of cold storage warehouses owned by different sectors. The values in the parentheses indicates share of each sector within the region.

From Table 8, it can be observed that the total storage capacity of private cold storage warehouses was largest (95.80 percent) followed by cooperative cold storage warehouses (3.70percent). The reason for higher concentration of private cold storage warehouses was due to various schemes funded by government institutions. Some of those schemes were Rural Godowns Scheme by DMI in collaboration with NABARD and National Cooperative Development Cooperation (NCDC). Capital Investment Subsidy Scheme for Construction/ Expansion/ Modernization of Cold Storage for Horticulture Produce (NABARD/NCDC/NHB/NAFED). Horticulture Mission for North Eastern and Himalayan States (HMNEH) scheme for Post Harvest Management including Cold Storages. Schemes under agricultural cooperatives as National Horticulture Mission (NHM), National Horticulture Board (NHB), Scheme under Agricultural and Processed Food Products Export Development Authority (APEDA) for Common Facility including Cold Storage and schemes under Ministry of Food Processing Industries (MOFPI) (INDIASTAT, 2015).

Northern region has more number of larger cold storage warehouses with a storage capacity of 17.03 million MT. Though the Western region was concentrated in more number of private cold storage warehouses, Eastern region had larger capacity private cold storage warehouses. Similarly, Northern region had more concentration of cooperative cold storage warehouses than Eastern region, while Eastern region had larger cooperative cold storage warehouses than Northern region.

Table 9: Region-Wise Cold Warehouse Storage Capacity Based on Sector
(In metric tonnes)

Region	Private Sector	Cooperative Sector	Public Sector
Eastern	7464648 (24.48)	542675 (46.05)	31416 (19.86)
Western	4044909 (13.27)	192086 (16.30)	32818 (20.75)
Northern	16558704 (54.31)	411571 (34.92)	66168 (41.83)
Southern	2418790 (7.93)	32122 (2.73)	27794 (17.57)
Total	30487051 (100.00)	1178454 (100.00)	158196 (100.00)

(Figures in parentheses indicate percent to total)

The values in Table 9 represent the storage capacity of cold storage warehouses under each sector and each region. The values in the parenthesis indicate sector-wise share of cold storage warehouses in terms of their storage capacity across the four regions.

From Table 9, it can be observed that the private cold storage warehouses were higher in Northern region (54.31 percent) in terms of storage capacity followed by Eastern (24.48 percent) and Western regions (13.27 percent). Around 46.05 percent of larger cooperative cold storage warehouses were located in Eastern region and 41.83 percent of public cold storage warehouses were located in Northern region.

SUMMARY AND CONCLUSIONS

The cold storage industry in India is over a hundred-years old. It has adopted gradual change in technology. The Indian cold storage market is valued at Rs. 117 billion and is expected to reach Rs. 558 billion by the end of 2015. Cold storage units in the 1960s were built only for storage of potatoes and seed potato but as the commodity base widened, different types of cold store facilities were built. At present there are 6891 cold stores in the country with an installed total capacity of 31.8 million metric tonnes.

Results of this study showed that concentration of Cold storage warehouses was higher in the Northern region followed by Western, Eastern and Southern regions in that order while the total capacity of cold storage warehouse was largest in Northern region because there was more number of large cold storage units for storing potatoes.

Potatoes based cold storages were highest in Northern region (67.27 percent) followed by Eastern region (19.68 percent), because potato production and consumption is higher in these regions especially in Uttar Pradesh, West Bengal and Bihar which contributed 71.99 percent of total potato production in India. The CSW's specialized in fruits and vegetables were higher in Western region (67.34 percent) where mostly the fruits such as grapes, oranges, mosambi etc., were stored. Cold storage warehouses for storing meat and fish were higher in Southern region (57.76 percent) since Andhra Pradesh, Tamil Nadu, Karnataka and Kerala put together, accounted for 44.09 percent of fish production in India. Cold storage warehouses storing milk and milk products were concentrated in Western region 22.57 percent of country's milk production was from these five states of Western region viz. Gujarat, Madhya Pradesh, Maharashtra, Goa and Chhattisgarh (NDDDB and INDIASTAT, 2014). Other than these five commodity-based cold storage categories, the other cold storages were smaller cold storages maintained at retail level or by the restaurants, hotels and at airports. These cold storage warehouses were more concentrated in Western region and especially in Maharashtra state.

In terms of Capacity, the cold storage warehouses for storing potatoes was largest (74.73 percent) followed by multipurpose cold storages (22.24 percent). In Northern states such as Himachal Pradesh, Jammu and Kashmir and Uttar Pradesh, some of the multipurpose CSW's stored apples and other deciduous fruits. In Southern region the multipurpose cold warehouses stored commodities such as chilli, tamarind, turmeric, coriander, bengalgram, blackgram, corn, etc., were more in numbers with a storage capacity of 1.76 million metric tonnes.

The cold storage warehouse for storing fruits and vegetables (1.56 lakh MT), meat and fish (2.25 lakh MT), dairy products (1.53 lakh MT) and others (1.54 lakh MT) was larger in terms of capacity in the Southern region even when the number of CSW was lesser.

Among the four regions, Northern region has the largest storage capacity owing to larger capacity of potato storing cold storage warehouses.

In all the four regions, the concentration of private cold storage warehouses was more (90.55 percent). Earlier to 2010, the concentration of cooperative cold storage warehouses was very less which has tremendously increased during the span of next five years.

The total storage capacity of private cold storage warehouses was largest (95.80 percent) followed by cooperative cold storage warehouses (3.70 percent). The reason for higher concentration of private cold storage warehouses was due to various schemes funded by government institutions. Some of those schemes were Rural Godowns Scheme by DMI in collaboration with NABARD and National Cooperative Development Cooperation (NCDC). Capital Investment Subsidy Scheme for Construction/ Expansion/ Modernization of Cold Storage for Horticulture Produce (NABARD/NCDC/NHB/NAFED). Horticulture Mission for North Eastern and Himalayan States (HMNEH) scheme for Post Harvest Management including Cold Storages. Schemes under agricultural cooperatives as National Horticulture Mission (NHM), National Horticulture Board (NHB), Scheme under Agricultural and Processed Food Products Export Development Authority (APEDA) for Common Facility including Cold Storage and schemes under Ministry of Food Processing Industries (MOFPI).

The private cold storage warehouses were larger in Northern region (54.31percent) in terms of storage capacity followed by Eastern (24.48 percent) and Western region (13.27 percent). Around 46.05 percent of larger cooperative cold storage warehouses were located in Eastern region and 41.83 percent of public cold storage warehouses were located in Northern region.

However it must be realized that for a country which is number one in terms of milk production and second in terms of fruits and Vegetables production, the overall storage capacity of cold storage available in the country cannot be considered adequate and there seems to be a good potential for the development of modern and energy efficient storage units. There are number of gaps in India's cold chain, beginning with a need for research and development to standardize and enhance processes from postharvest handling to maintaining proper temperature throughout the cold chain. There is also a gap in labour availability and expertise. The cold chain in India needs trained cold chain professionals including operators, engineers, security specialists, and logistics managers. These requirements can only be fulfilled with an intervention of private sector, through public-private partnerships.

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